Serial No. 09/735,930

REMARKS

Claims 1-11 have been canceled and new claims 12 to 23 are presented for consideration.

1. Applicants thank the Examiner for the courteous interview granted their attorney on May 11, 2004. The substance of applicants' arguments made at the interview appears below.

The Examiner made a suggestion to claim the invention as three independent claims and applicants are following that suggestion; hence, new claims 12 to 23. The present invention in principle is a catalyst body having three elements:

(1) a honeycomb carrier containing at least one main component;

(2) a catalyst layer with an alkali metal; and

(3) an anchor substance that reacts with the alkali metal in a manner that dominates over any reaction between main components of the carrier and the alkali metal.

The catalyst layer also contains, in addition to (a) the alkali metal,

(b) a heat-resistant inorganic oxide, and

(c) a noble metal loaded on the heat-resistant inorganic oxide.

The anchor substance may be present:

(a) in the catalyst layer,

(b) in the carrier itself, or

(c) between the carrier and the catalyst layer.

The previously pending claims have been canceled; three independent claims are presented defining the location of the anchor material. The arrangement immediately above is reproduced with the independent claim number for the three locations where the anchor substance in located:

(a) in the catalyst layer (claim 12),

(b) in the carrier itself (claim 16),

(c) between the carrier and the catalyst layer (claim 20).

For each independent claim, claims corresponding to former dependent claims 2, 3 and 8 are added. The description of the carrier as a honeycomb from former claim 7 is added to all of the independent claims. Finally, the element Ti does not appear in the list of the anchor substances for the case where the anchor substance is located in the catalyst layer in claim 13 to advance the prosecution of this application.

2. Claim 2 was discussed at the interview. The Examiner asked if, when cordierite was used as the carrier, Si could be an anchor substance. Cordierite is magnesium aluminum silicate of the formula $Mg_2Al_4Si_5O_{19}$. The apparent basis for the Examiner's concern was that Si was also found in the carrier. However, since the interview it was realized that this matter is discussed in Paragraph [0009] on page 4 of the specification; see lines 8-10. There it is stated what when reactive K is used as the NO_x catalyst, the preferred anchor substances are Si, P, Ti, Cr, Mo and W. Thus, there is no need to add a "whereby" clause at the end of claim 2 to exclude Si as discussed at the interview.

3. The rejection based on Lindner at al. taken with Deeba et al. has at the end thereof comments regarding the specification and claims. These matters are addressed below in five sections.

3a. The specification does not clearly describe the addition of potassium directly to the carrier.

The three independent claims specify that the alkali metal is to be in the catalyst layer. Thus this point is moot.

3b. Applicants interpret Claim 1, line 4, as if the comma after "metal" is absent. Perhaps then it should be removed.

The three independent claims 12, 16 and 20 define the alkali metal as in the catalyst layer. The comment on claim 1 is moot.

3c. Claim 1 does not require a reaction between the carrier and the alkali metal, nor between the "substance" and the alkali metal.

The three independent claims 12, 16 and 20 define the "anchor substance" as a substance "that reacts with said alkali metal in a manner that dominates over any reaction between main components of the carrier and said alkali metal." This language meets the point raised by the Examiner.

3d. The claims are more broad than what is argued - claim 1 does not require that the "carrier" be different from the "heat-resistant inorganic oxide". Alumina by itself meets both properties, so the claims do not require a 4 component catalyst.

The three independent claims 12, 16 and 20 list the catalyst body components. The heat-resistant inorganic oxide is part of the catalyst layer and it is different from the carrier.

3e. Likewise, the "noble metal" can itself be the "catalyst layer".

The three independent claims 12, 16 and 20 specify that the "noble metal is loaded on the heat-resistant inorganic oxide" and this combination is part of the catalyst layer comprising an alkali metal. These two components are distinct.

4. Claims 1-3, 5, 7, 8, 10 and 11 were rejected under 35 U.S.C. 102(a) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iizuka et al. 5,968,870. All of the claims have been canceled and three independent claims 12, 16 and 20 are presented as discussed in Section 1 above. This rejection is traversed if applied to the new claims.

The present invention is directed to solving a problem caused by the adverse effect alkali metals have on a catalyst carrier in catalyst compositions when the catalyst operates at high temperatures. This problem is discussed on page 2, lines 2-10, of the specification thusly:

> The carrier, however, is easily corroded and deteriorated by alkali metals or some alkaline earth metals being activated under high temperature conditions derived from automobile exhaust gas, especially, Li, Na, K and Ca. In particular, there is a serious problem that a cordierite carrier made of an oxide type ceramic material generates cracks, since the carrier easily reacts with the above-mentioned alkali and alkaline earth metals, etc.

Applicants solved this serious prior art problem by inventing a catalyst with a long duration period. The catalyst of this invention is formed by adding an "anchor" material (called in the amended claims "an anchor substance that reacts with the alkali metal, dominating over the reaction between the main components of the carrier and the alkali metal") that will react with these alkali metals in a manner greater than the catalyst carrier does. See also specification Paragraphs [0005] and [0006]. Preferred "anchor" materials are recited in claims 13, 17 and 21. There is no teaching in the cited art of adding such an "anchor" material to a catalyst composition for any reason, let alone to solve this durability problem.

The Examiner contends that Iizuka et al. '870 teaches in col. 4 impregnating a honeycomb first with alumina, and then with Na, Ti and Pt, and that "no difference in the catalyst is seen; compare to specification examples."

Iizuka et al. '870 discuses preparation of a catalyst (see col. 4, lines 31-54,) using the following steps:

1. An alumina coated honeycomb having an alumina coating of nearly 160 g per apparent volume of honeycomb of 1 liter was obtained by coating a slurry, which was formed of alumina powder, aluminum nitrate, and aluminum hydroxide, and prepared in nitric acid, to a honeycomb (400 cells/in^2) made of cordierite; and the alumina coated honeycomb was then dried and baked.

2. The alumina coated honeycomb was impregnated with Ce nitrate solution, then dried at 200°C., and baked at 700°C. for 1 hour.

3. The alumina coated honeycomb was impregnated with a mixed solution of Na nitrate and Mg nitrate and nitric acid titania sol, and dried and baked using the same conditions as above.

4. Further, the alumina coated honeycomb was impregnated with a mixed solution of dinitro-diamine Pt nitrate solution and Rh nitrate solution, then dried at 200°C. and baked at 450°C. for 1 hour.

5. Finally, the alumina coated honeycomb was impregnated with Mg nitrate solution, dried at 200°C., baked at 450°C. for 1 hour, and baked at 700°C. for 5 hours.

The reason for using Ti is explained in Iizuka et al. '870 at col. 2, lines 35-39:

> The reason the catalyst in the present invention has a high purification capacity for NO_x is that a high affinity for NO_x is created by Ti coexisting with alkali metal NO_x is absorbed on a surface thereof, and the absorbed NO_x is reduced by a coexisting with noble metal.

The Ti is only for coexisting with the alkali metal to increase the affinity of NO_x for the alkali metal. There is no suggestion that the Ti would prevent deterioration of the carrier when the carrier reacts with an alkali metal.

As indicated in Section 1 above, Ti has been deleted from the list of anchor substances in claim 13 and thus there is no teaching of the anchor substances of claim 13.

As to the embodiments in claim 16 (anchor substance in the carrier) and claim 20 (anchor substance between the carrier and the catalyst layer), there is no teaching of such a catalyst structure from Iizuka et al. Note especially Iizuka et al. was

not applied to claim 9, which is the subject matter of present claim 16.

Accordingly, review and withdrawal of this rejection are requested.

5. Claims 1-3, 5 and 7-11 were rejected under 35 USC 103(a) as unpatentable over Lindner et al. '430 "taken together with" Deeba et al. '910. All of the claims have been canceled and three independent claims 12, 16 and 20 are presented as discussed in Section 1 above. This rejection is traversed if applied to the new claims.

The rejection made in the paper mailed September 16, 2003 was incorporated by reference in the present rejection.

The Examiner admits in the paper mailed September 16, 2003 at page 5, line 1 that Lindner et al. '430 "does not disclose alkali metal." Rather noble metals of the platinum group are used, see col. 1, lines 60-62, to treat nitrogen oxide (col. 1, lines 56-57). Three-way catalysts are defined in col. 1, lines 16-27, as capable of treating CO, NO_x and HC. In the Summary of the Invention in col. 4, these noble metal catalysts are described as good three-way catalysts; see lines 48-60.

There is no proper reason to look to the teachings of Deeba et at. '910 and conclude that alkali metal could or should be used in the Lindner et al. '430 three-way noble metal catalyst construction for the reasons of record.

The person of ordinary skill in the art would have no motivation to combine the teachings of Lindner et al. '430 and Deeba et al. '910 to solve the prior art problems discussed in the paragraph [0003] bridging pages 1 and 2 of the specification. Neither reference discusses the problems caused by the use of alkali metals as NO_x adsorbents, which problems are solved by the present invention. There are also major differences in catalytic mechanism, function, and operation between a ternary catalyst and an NO_x adsorption catalyst.

If no alkali metal is disclosed in the primary reference (as the Examiner admits), why would the person of ordinary skill in the art have any reason to look Deeba et al '910 in an effort to solve the corrosion and/or deterioration problems caused by the presence of alkali metals in NO_x adsorption catalysts? The secondary reference does not discuss alkali metals and an anchor material therefor, or as described in independent claims 12, 16 and 20, "an anchor substance that reacts with the alkali metal

in manner that dominates over any reaction between main components of the carrier and said alkali metal." The basis for the combination of references rejection shows that the Examiner has been looking improperly to what is said in applicants' specification (impermissible hindsight) rather than to what the reference themselves say.

The argument directed to the "optional" use of an alkali metal in Deeba et al. '910 is used in support of applicants' position that the subjects matter of the two references are sufficiently unrelated that one, absent the hindsight provided by applicants' specification, would have no reason or desire to combine them. If an alkali metal is an optional component in Deeba et al. '910, then clearly the reference is not directed to dealing with problems that are caused by the presence of an alkali metal.

Applicants again respectfully submit that the systems of Lindner et al. '430 and Deeba et al. '910 are drastically different and merely because the systems are used in exhaust gas catalysts, that characteristic does not justify the instant rejection.

The Significance of These Two References Being Directed to Different Types Of Automotive Catalysts

a) Linder - Passive Catalyst System - Operating at Stoichiometric Point

The Linder catalyst is a three-way catalyst system used for normal engines where exhaust gas is controlled to the stoichiometric point. This catalyst system is a "passive" catalyst system, that is, it converts CO, HC, and NOx to harmless components at the same time and constantly in a stoichiometric atmosphere.

This catalyst is composed generally of:

1) a noble metal,

2) a support (heat resistant inorganic oxide such as γ-Al_2O_3), and

3) an oxygen storage material (such as CeO_2 to keep the exhaust gas composition stoichiometric).

b) Deeba - Active Catalyst System - Operating in a Lean Atmosphere

The Deeba catalyst is for an NOx adsorption catalyst system that is used for a lean burn engine or a direct injection engine where the exhaust gas is in a lean atmosphere, that is, there is

excess O_2 in the atmosphere. This catalyst system is an "active" catalyst system, that is, it adsorbs NOx during lean operation. Then introducing a rich spike at intervals discharges the adsorbed NOx, and the discharged NOx is converted to harmless components, so that saturation of NOx in the adsorption material is avoided.

This catalyst is generally composed of:

1) a noble metal,

2) a support (heat resistant inorganic oxide such as γ-Al_2O_3), and

3) an NOx adsorption material (such as Ba, K to hold NOx in the form of nitrate).

As noted, the treating gas and the reaction mechanisms of Linder and Deeba catalyst systems are totally different. Thus, a skilled person would not think that an effective component for one catalyst system is effective for another catalyst system acting by a different reaction mechanism. This belief is a common sense one in chemistry. Therefore, without any suggestion or teaching to do so, the skilled person could not combine the Linder and Deeba teachings.

In other words, because these two references relate to different types of automotive catalysts, no suggestion is provided by or in the references to combine their features. As already noted, the recited objects for the Lindner catalyst establish that it is merely an ordinary automotive catalyst with noble metals to provide for high temperature resistance. Deeba, on the other hand, is directed to a NO_x conversion catalyst primarily having an alkaline earth (Ba) component. There is no suggestion to the person of ordinary skill in the catalyst art to take a Deeba NO_x catalyst component and randomly add it to a conventional noble metal-containing auto exhaust catalyst. There is no reason, other than by the improper resort to hindsight, to do so. There clearly is no teaching in these two references of the unexpected and superior results obtained by applicants and compiled in Tables 1 and 2 of the specification.

In view of the foregoing remarks, it is respectfully submitted that claims 12 to 23 are in condition for allowance and a USPTO paper to those ends is earnestly solicited.

The Examiner is requested to telephone the undersigned if additional changes are required in the case prior to allowance.

Respectfully submitted,

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